Washington State Department of Transportation

Washington State Ferries

Keystone Citizen Advisory Group

Keystone Harbor Study

Physical and Computer Modeling

Objectives

Evaluate alternatives for modifying the Keystone Harbor jetty based on:

1. Cross current velocities
2. Waves in the channel and harbor
3. Sediment transport, sedimentation of the channel, and maintenance dredging requirements
4. Water quality

Methodology

The harbor analysis study looked at ten alternatives for modifying the jetty, plus a no action baseline alternative. All alternatives were run through computer and physical models. The physical model was used to calibrate and validate results of the computer model.

Key Findings

- Two alternatives were found to be the most technically feasible:
  2. Jetty extension with dogleg
  3. Jetty relocation and widened harbor entrance
- The jetty was built in 1949 to prevent sedimentation at the entrance to Keystone Harbor. It was not intended to reduce cross currents at the mouth of the harbor or to improve ferry operations.

  "The purpose of the breakwater, or jetty, is primarily to prevent shoaling of the entrance channel by encroachment of gravel that is being moved along the beach from the east …"

  – Budget request letter to U.S. House of Representatives from U.S. Army Chief Engineer, April 1941

- Both the Dogleg and Relocation alternatives provide improvement to cross current velocities:
    - The Dogleg alternative would provide a 50-70% reduction of cross current velocities, but for a short distance from the jetty.
    - The Relocation alternative would provide a 30-50% reduction of cross current velocities for a longer distance from the jetty.
    - The Relocation alternative would reduce shear currents at the harbor entrance.
    - The Relocation alternative provides a wider channel for maneuvering into the harbor.
- Wave modeling results:
    - The Dogleg alternative would not alter wave conditions at the entrance.
    - The Relocation alternative would slightly increase wave heights in the harbor during extreme storms.

- Neither alternative would increase sedimentation and maintenance dredging requirements.

- The Dogleg alternative would have a slight negative effect on water quality in the harbor, while the Relocation alternative would improve water quality in the harbor.

- Neither alternative would have an effect on shoreline erosion to the east of the jetty.